PCT/AU2005/000356

Australian Government

Patent Office
Canberra

I, JANENE PEISKER, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004907402 for a patent by FRANK DANIEL LOTRIONTE as filed on 10 September 2004.

WITNESS my hand this
Fourteenth day of April 2005

JANENE PEISKER
TEAM LEADER EXAMINATION
SUPPORT AND SALES

2004907402 10 Sep 2004

AUSTRALIA
Patents act 1990

COMPLETE SPECIFICATION
STANDARD PATENT

COMPACT TURBINE IMPELLOR

The following statement is a full description of this invention , including the best method of performing it known to me :

2004907402 10 Sep 2004

COMPACT TURBINE IMPELLOR

Technical category : Mechanical , electrical.

This invention relates to a high efficiency turbine impellor designed to capture the maximum of energy from a moving gas / fluid flow whilst remaining relatively basic and unencumbered.

BACKGROUND

Typically, impellors , especially wind turbine impellors , are commonly based on slightly modifyed propellors designed to minimise torsional or centrifugal stresses at speed that do not fully utilise the potential energy present in the surrounding wind or gas / fluid flow, because they position a large portion of their deflective surface areas toward their hub where it can least effectively transform deflective forces into available torque and have proven to be quite noisy at the high flow velocities which are needed for them to achieve their rated power outputs , and so have low levels of community appeal .

This inventor has determined that it is advantageous to maximise the amount of working surface area located at the outer extremities of a turbine impellor by a method that does not excessively restrict or inhibit flow or structurally weaken the impellor beyond usefullness and at present extended or very wide outer portions of impellor blade design have been discouraged without the incorporation of an annular stiffening rim /duct

STATEMENT OF THE INVENTION

This invention seeks to provide an increase in the efficiency of any wind , water , steam , or gas turbines that have a rotation axis parallel to fluid flow by using a plurality of blades that combine a generally frontward projecting elongated blade tip extending from the outer end of slightly rearwardly tilted blade of typical design albeit shortened , aiding the formation of a low-pessure vortex preceding the turbine by utilising the flow of surrounding gas/ fluid past the outer turbine perimeter to lower internal pressure providing an increase in through- flow velocity without the need for exterior ductwork or funnels and having a large porsion of the through- flowing medium being directed outwardly and rearwardly instead of mainly rearwardly overcomes the shortcomings of previous impellors having wide - ended blades.

As the blade / vane is balanced (both in weight distribution and twisting forces due to fluid / gas flow reactions , about its central mounting point on a hub or shaft , there is no need for a stiffening annular rim attached to the perimeter or midsection of the blades , which simplifies manufacturability whilst retaining the ability to operate at high angular velocity with little undue flexing or failure due to stress and this design retains the possible inclusion of blade articulation to a lesser attack angle for the purpose of speed limiting in extreme conditions
In one form of this invention , substansially vertical curved slots have been positioned in the outer end of the blades to increase the deflection forces due to fluid or gas flow at this point balancing the moment forces applied by extraordinarily pronounced forward - projecting blade tips , which as a whole provides great effectiveness at low - medium gas velocities . This impellor design has the potential to greatly increase the output of any turbine system with quieter operation or provide the same output from a lesser working diameter.

The impellor may be made of steel , alloys , composites , plastics , or any mixture of these and could be formed , welded , rivetted , bolted , cast , pressed , inserted , cavity moulded , vacuum formed, roto - moulded, laminated , integrally constructed or otherwise assembled using any combination of these .

2004907402 10 Sep 2004

To assist with understanding the invention , reference will now be made to the accompaning drawings which show details of one example of this invention.

In the drawings :

Figure 1 shows a top view of the preferred embodiment.

Figure 2 shows the frontal view of the preferred embodiment.

Figure 3 and Figure 4 show section cutaway views of the blade / vane.

Figure 5 shows an isometric view of the preferred embodiment.

Figure 6 " a " shows a possible multistage turbine embodiment .

Figure 6 " b " shows a method of achieving blade angle of attack adjustment with the central mounting shaft being articulated by mechanical means built into the hub.

Figure 6 " c " shows an embodiment without slots that may be more easily and less costly manufacturable using the pressed metal or vacuum formed methods .

Figure 7 shows a face - on view of a typical blade / vane of the preferred embodiment with reference to the preferred design formulae scaled for any given turbine diameter. (D)

Referring to Figure 1 , A plurality of slightly concave section blades # 3 extend out substansially radially with a small rearward tilt , a leading edge also rearwardly sloping between 15 and 60 degrees (ϕ Figure 7) equi-spaced around a hub # 4 that preferably has a bullet nose shape and an axis of rotation # 6 parallel to incoming gas / fluid flow # 12

blending smoothly with a gradual curve into the rear end of substansially frontwardly protruding " vanes " # 1 containing a generally concave or "spoon " section (Figure 4)

all being twisted in a helix angle θ around the said hub axis # 6 to present a gradually rearwardly and outwardly increasing " attack angle " in relation to incoming fluid / gas flow .

The vanes # 1 each having a leading edge angle ω #7 of between 15 and 75 degrees , a trailing edge angled between 0 and 50 degrees (α Figure 7) in relation from the hub axis # 6
are generally of thinner cross section than the blades # 3 and preferably contain slots # 5 that are preferably set approximately perpendicular to the majority of gas / fluid flow in this region # 11

2004907402 10 Sep 2004

The slots # 5 may contain a radius or aero- foil shape on their respective rearward outer edges to minimise turbulence and increase " lift " with slot inclusion or positioning preferably to add to the total deflective forces due to gas / fluid flow on the

rearward end of the vane they are cut into (see length " Y " Figure 7) enabling forces to remain balanced by the possible inclusion of an exceptionally pronounced vane tip length (see length " X ") Figure 7 even though length " Y " is preferably shorter than length " X "

I E The sum of " lift " or deflective forces (CL max " Y" x length "Y ") is preferably equal to the sum of the" lift " or deflective forces (CL max " X" x length " X ") about a central line # 8 passing through the centroid # 10 of the blade / vane mass and also the center of the blade / hub junction # 9 drawn perpendicular to the hub axis .

In this way total balance may be acheived countering unwanted or extraneous stresses within the impellor even though it may be not initially appear so , enabling moderate rotational speed

Where : CL max equals lift coefficient for aero foil section
D equals impellor diameter
Centroid # 10 equals the point about which the sum totals of the blade / vane mass is considered to be centered upon .

The hub could be constructed in any shape or size and still function , but preferably increases in diameter " bullet shaped " toward the rear of the impellor helping to direct flow outwards and rearwards without imparting excessive turbulence and providing a

possible housing for blade articulation mechanisms , a generating unit or connection to a suitable output shaft and / or support bearings .

It can be seen from Figure 1 that the general shape of the complete impellor is designed to impart a fluid or gas flow pattern that has a substansial outward direction as it moves

further into and completely through the remainder, not going against centifugal forces present and substansially increasing as the turbine approaches optimum operating speed.

This is not a new concept , however this invention seeks to obtain the best overall efficiency by positioning the bulk of the blade / vane surface area toward the impellor

periphery in a manner that does not unduly restrict through - flow or ultimate angular velocity as maximum power is produced when all of these conditions are met.

All the leading and trailing edges are preferably suitably rounded to minimise turbulence and the blade section is sufficiently strong enough to adequately transform or direct the sum of the deflection or " lift " forces from the blades , vanes and slots due to fluid / gas flow into torque at the hub or shaft .

The claims defining the invention are as follows :

1.
A turbine or impellor that consists of a plurality of outwardly extending preferably concave section blades # 3 that may contain a rearward tilt, and each having a substansially frontwardly projecting extension of pronounced length , #1 (hereby called a vane) containing a generally concave or " spoon section " being presented to the gas / fluid flow and a width preferably reducing toward its frontward extremity , seamlessly joined to their outer frontward edges with a smooth curved blending all being rotatably displaced , equi-distant and joined by their innermost ends to a hub or shaft having its axis parallel to incoming gas / fluid flow.

2.
A turbine or Impellor with its " blades / vanes " as claimed in claim 1 oriented between 20 - 70 degrees from the rotation axis # 6 when viewed from the top with the vane section #1 having a slightly lesser angle of incedence θ than the blade and its inner leading edge converging toward the rear at an angle ω #7 of between 15 - 75 degrees from the axis of rotation and its trailing edge sloping inwards towards the hub rear at an angle α of between 0 and 60 degrees

3.
A turbine or impellor with its " blades / vanes" as in claim 1 radially displaced around a hub or shaft either in a permanently fixed position , or able to be articulated about the central mounting point line # 8 to adjust the angle of incedence to outside the definition as claimed in claim 2 to allow for its reduction to such an extent as to facilitate speed limiting when the maximum design speed has been reached in gale force winds or abnormal gas / fluid velocity .

4.
A turbine or impellor as claimed in claim 1 with blades or vanes that may contain there- in " slots" # 5 that have at their respective rearward edges a small radius or aero -foil section lessen turbulence , add to the "lift " force of the blade , aid balancing and also may contain a raised lip along on their inside rear edge for extra strength are preferably oriented and positioned to be averagely perpendicular to the wind / gas/ fluid flow at that point

5.
A turbine or impellor as claimed in claim 1 that has leading (towards airflow at that point) edges of the blades , vanes , slot edges contained within the vanes and /or blades preferably rounded with an elliptical radius to reduce turbulence or wind drag.

6.
A turbine or impellor as claimed in claim 1 that has the bulk of its blade / vane mass centroid # 10 situated between 0.25 - 0.45 of the diameter radially from the axis of rotation # 6

7.
A turbine or impellor as claimed in claim 1 that may be used in an inline or multyple axial multy - impellor turbine arrangement where the impellors may or may not revolve on the same shaft , hub or in the same direction.

8.
A turbine or impellor as claimed in claims 1 through to 7 that is moulded , laminated , cut formed , cast , forged , pressed ,sintered or fabricated from sheet metal , steel , alloys, plastics composites ,organic materials either as one unit or as assembled from individual components by riveting , bolting , welding , gluing , inserting or any combination of these.

9.
A fan or impellor as herein before described with references to Figures 1 - 7 of the accompaning drawings.

Frank Daniel Lotrionte 8 SEPTEMBER 2004

2004907402 10 Sep 2004

ABSTRACT

This invention seeks to provide an increase in the efficiency of any wind, water, steam, or gas turbines that have a rotation axis parallel to fluid flow by using a plurality of blades that combine a pronounced elongated blade tip projecting substansially forward and toward the direction of rotation in a " helix " angle from the outer end of slightly rearwardly tilted blade of typical design albeit shortened, aiding the formation of a low-pessure vortex preceding the turbine by utilising the flow of surrounding gas / fluid past the outer turbine perimeter to lower internal pressure providing an increase in through- flow velocity without the need for exterior ductwork or funnels
and having a large porsion of the through- flowing medium being directed outwardly and rearwardly together with a balanced blade design (both in weight distribution and twisting forces about their respective central mounting points on a hub or shaft) , seeks to overcome the shortcomings of previous turbine impellor design containing unusually wide blade tips , or horizontal projections without the need for a stiffening annular rim attached to the perimeter or midsection of the blades , which simplifies manufacturability whilst retaining the ability to operate at high angular velocity without undue flexing or flow restriction.

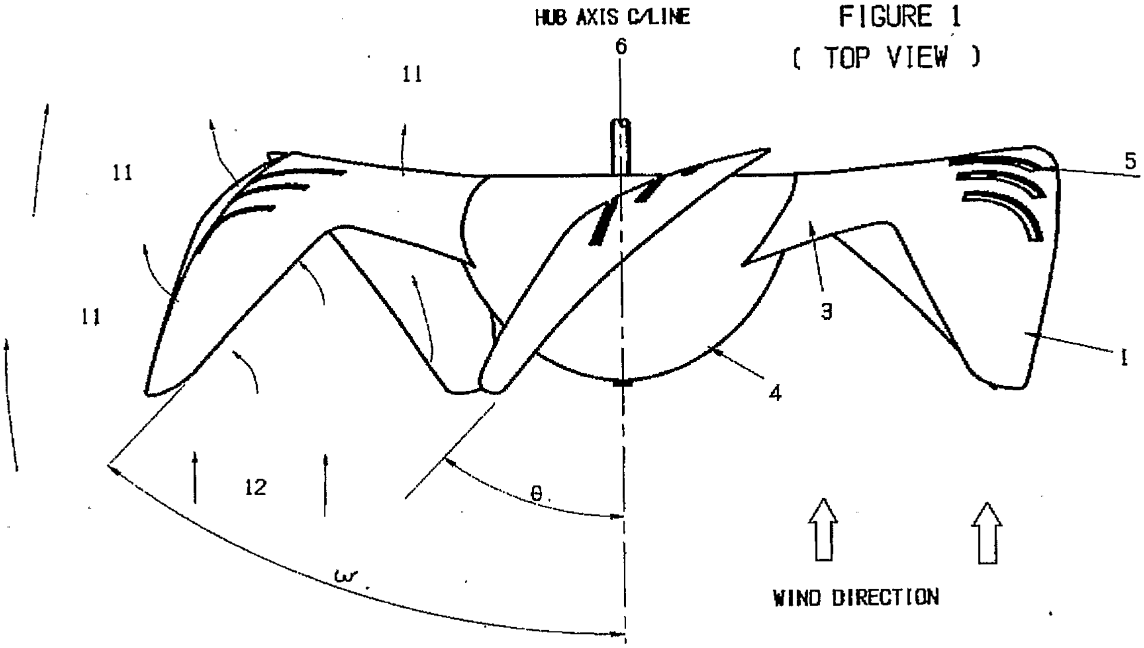


FIGURE 1
(TOP VIEW)

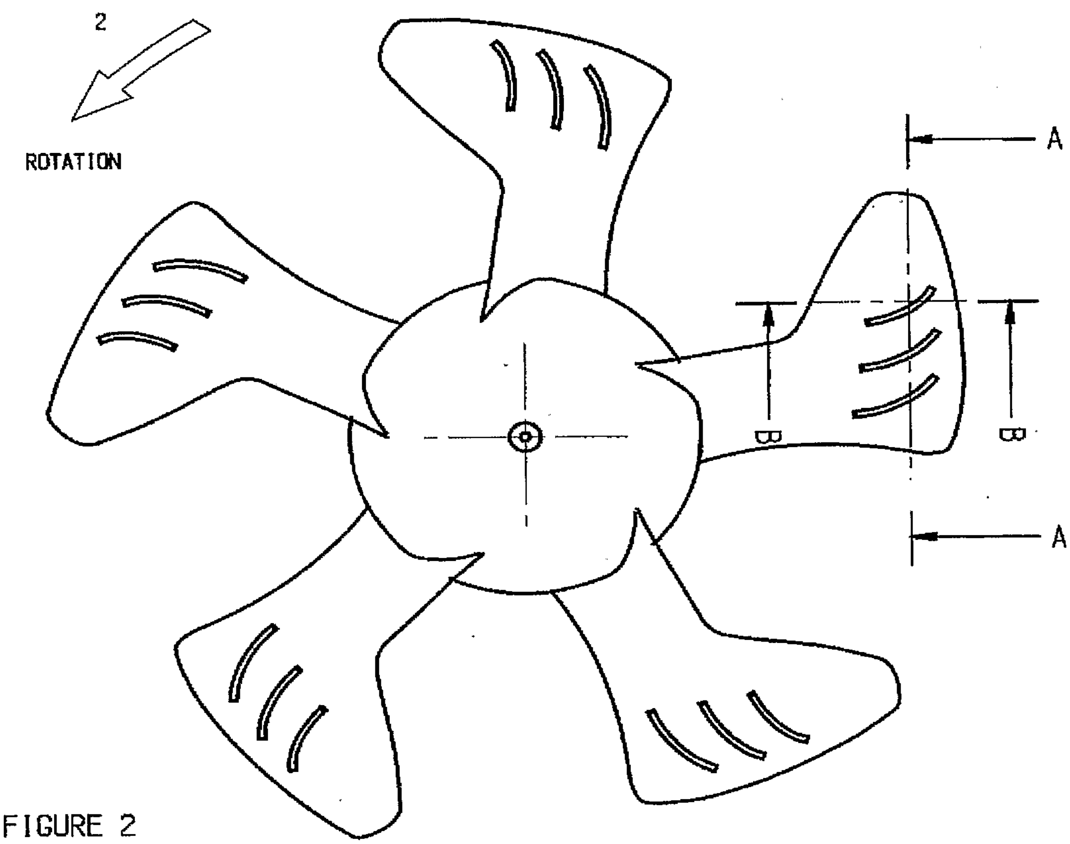


FIGURE 2
(FRONT VIEW)

2004907402 10 Sep 2004

FIGURE 3
(Section A -A)

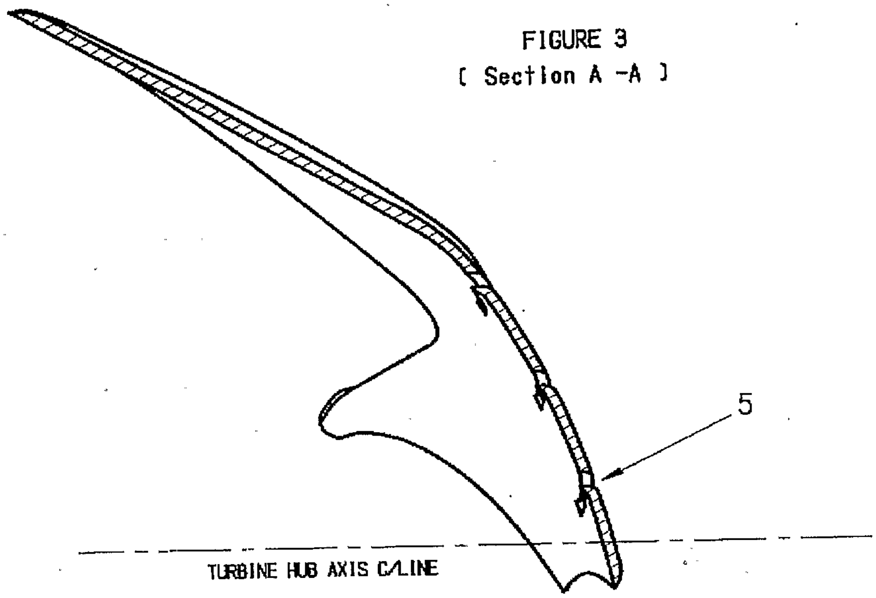
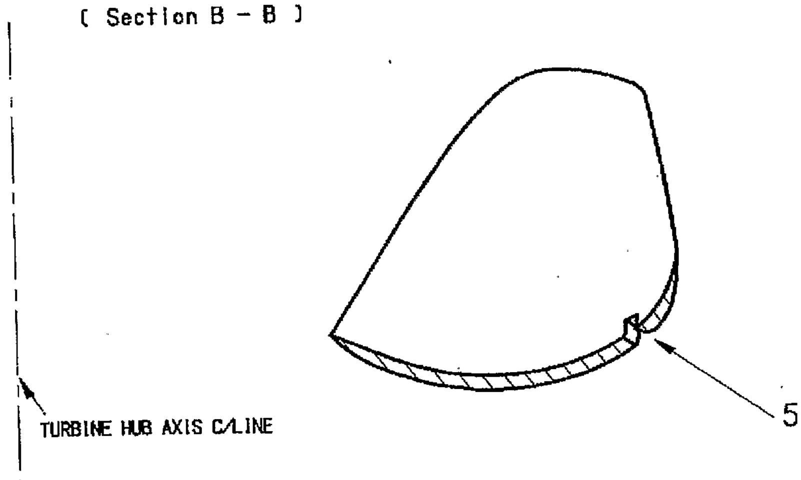


FIGURE 4
(Section B - B)



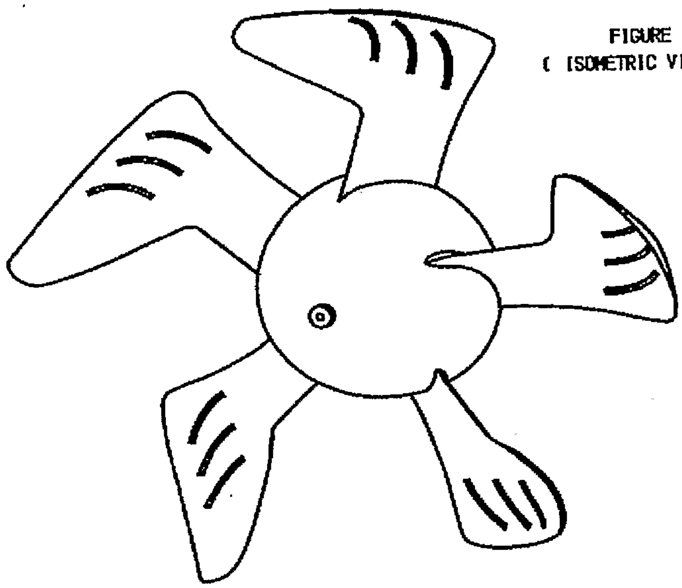
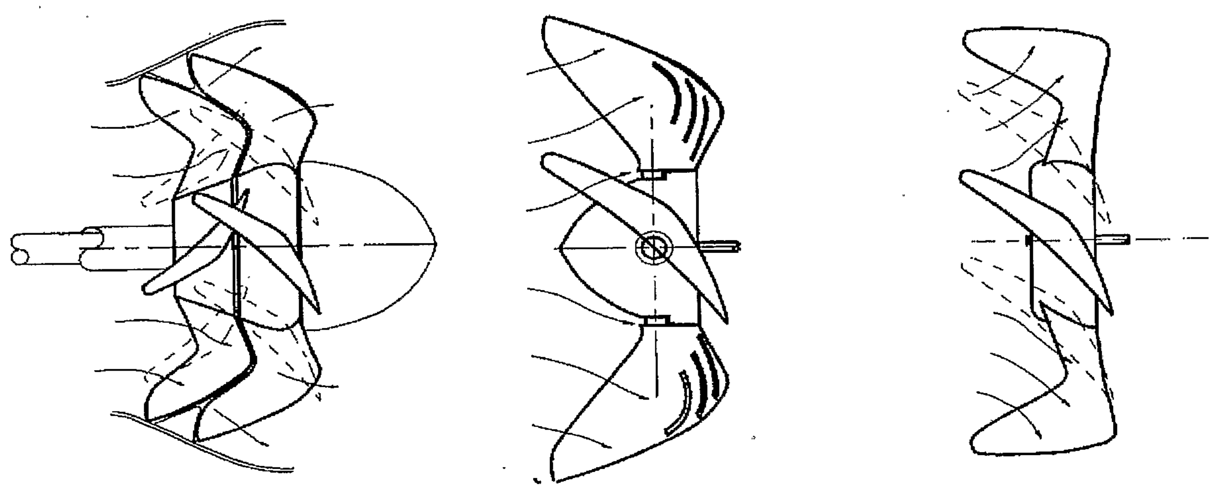


FIGURE 5
(ISOMETRIC VIEW)

FIGURE 6
(ALTERNATIVE EMBODIMENTS)
SIDE VIEW



Alt. embodiment " a "
multistage inline
turbine configuration

Alt. embodiment " b "
showing arrangment for blade
articulation to adjust attack angle θ

Alt. embodiment " c "
No slots - suitable for manufacturing
in formed sheet metals or plastics

2004907402 10 Sep 2004

FIGURE 7 (face-on view of vane)
(DEFINITION OF BLADE /VANE DIMENSIONS AND FORCES